



Keynote: From group collaboration to large scale social collaboration

François Charoy

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From group collaboration to large scale social collaboration

François Charoy - @charoy
Inria/University of Lorraine

EQUIPE PROJET
Coast
CENTRE Inria
Nancy Grand Est

Coast Team

Inria/LORIA research team (15/20 people)

University of Lorraine

Research topic :

Web Scale trustworthy collaborative systems

teams.inria.fr/coast

@InriaLORIACoast



Inria NANCY
Grand Est

Outline

Origin and (fly over) state of art of Computer Supported
Collaboration

Large scale collaboration (does it exists ?)

Perspectives and research issues



Dimensions of collaboration

Two or more people working together toward a shared goal

Communication

Coordination

Sharing

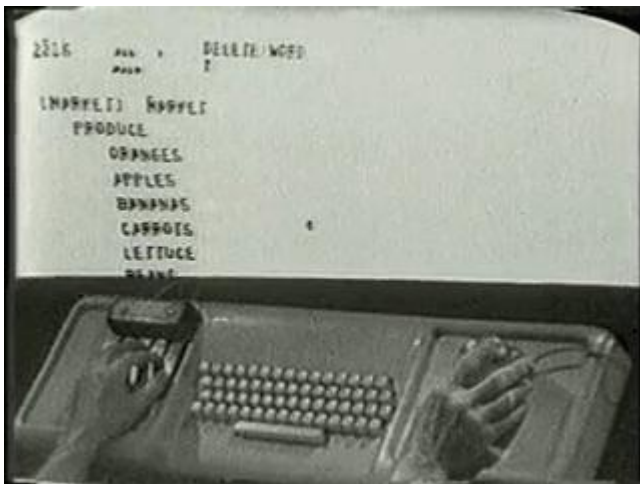
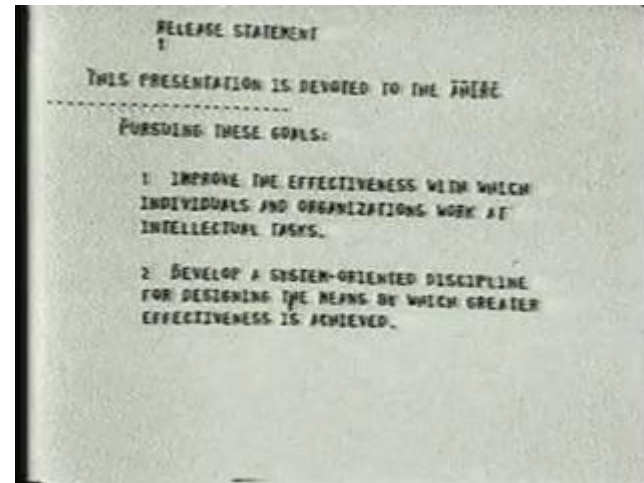
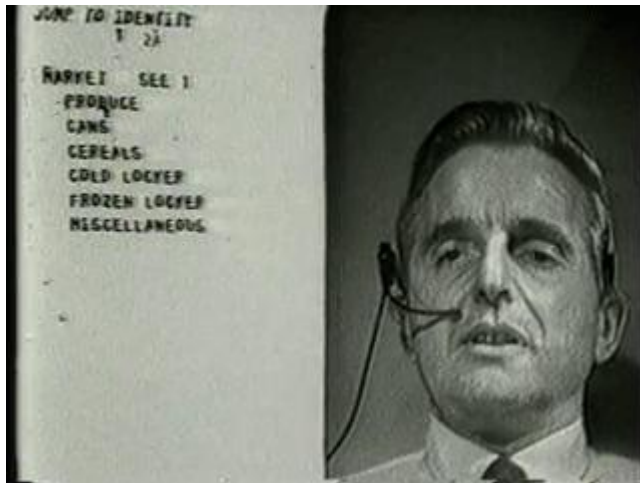
Implicit vs Explicit Coordination

 **THE** 
PERSUADERS!



Mother of all demos – 12/9/1968

Doug Engelbart Augmentation Project



<http://theyear1968.tumblr.com/post/79620814201/on-december-9-1968-doug-engelbart-and-his-team>

<https://archive.org/details/doungengelbartarchives>

Clarence Ellis 5/1943 – 5/2014

- Pioneer in collaboration software and workflow systems

GROUPWARE

SOME ISSUES AND EXPERIENCES

C.A. Ellis,
S.J. Gibbs, and
G.L. Rein

laboration of many specialists, including social scientists and computer scientists. CSCW looks at how

Groupware reflects a change in emphasis from using the computer to solve problems to using the computer to facilitate human interaction. This article describes categories and examples of groupware and discusses some underlying research and development issues. GROVE, a novel group editor, is explained in some detail as a salient groupware example.

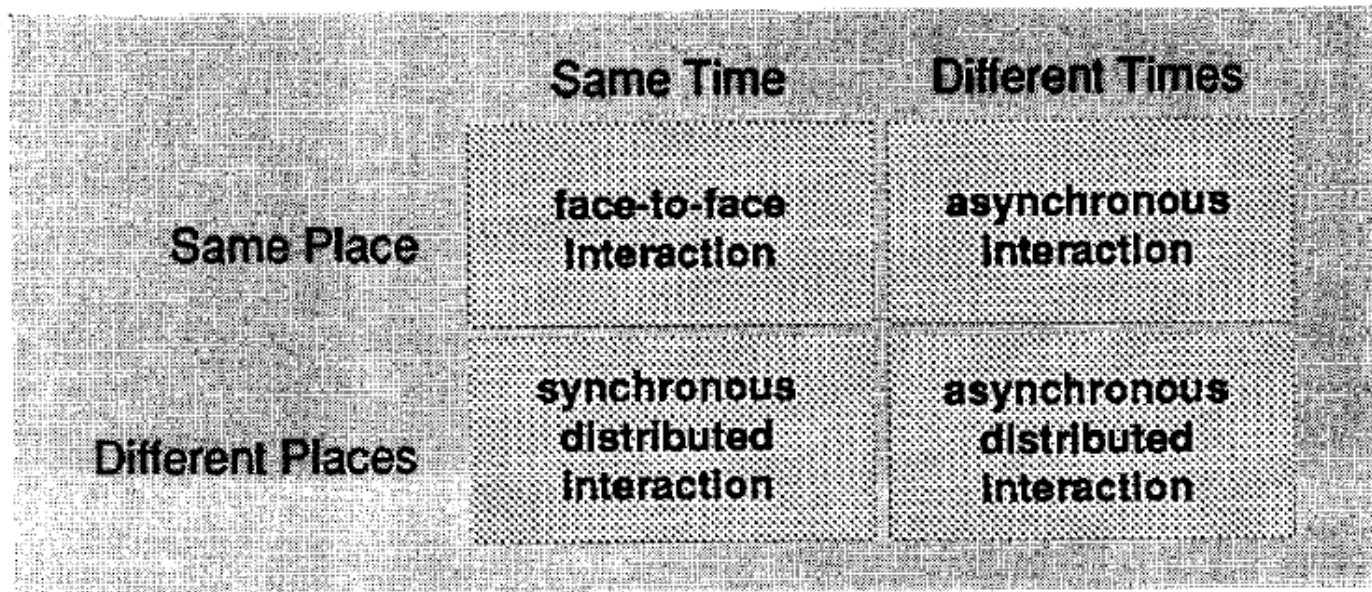
in this larger sense and delineates classes of design issues facing groupware developers. It is divided

**C.A. Ellis,
S.J. Gibbs, and
G.L. Rein**



COMMUNICATIONS OF THE ACM/January 1991/Vol.34, No.1

Taxonomy of Groupware



Office Automation (1979)

- SCOOP (Wharton and Sisman)
- OfficeTalk (Skip Ellis – Xerox Park)



File Index F1			
Memo		Dorothy Brown	
Blank Stock Index	ter	Larry Blue	
Dues		Edward Black	
Personal Letter		ACM	
		Joe Rainbow	

Out-basket			
Trace	Recipient	Subject	Sent
	John Green	Vacation Request	6/05/79

In-basket			
Trace	Sender	Subject	Received
	Dorothy Brown	Production Schedule	6/10/79
	John Green	Vacation Time	6/10/79
	Alice White	Budgets	6/11/79
	Edward Black	Salary Adjustment	6/11/79

Receive	Print	Copy	File	Send

International Widgets, Inc.
123 Color Way
Emerald City, CA 94304

TO: Oliver Rainbow DATE: 6/11/79

FROM: Edward Black

SUBJECT: Salary Adjustment

I have carefully reviewed your personnel folder and your progress

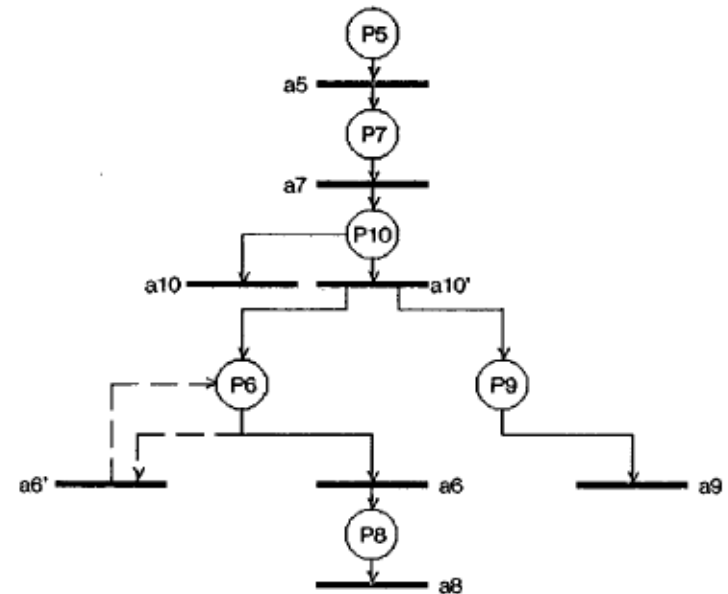
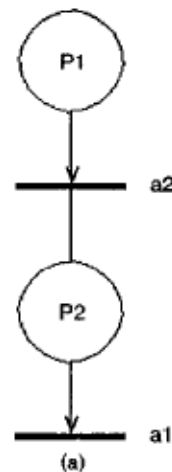


FIGURE 2. (a) Receptionist agent; (b) order administrator agent.

Challenges at the time

Office Information Systems and Computer Science

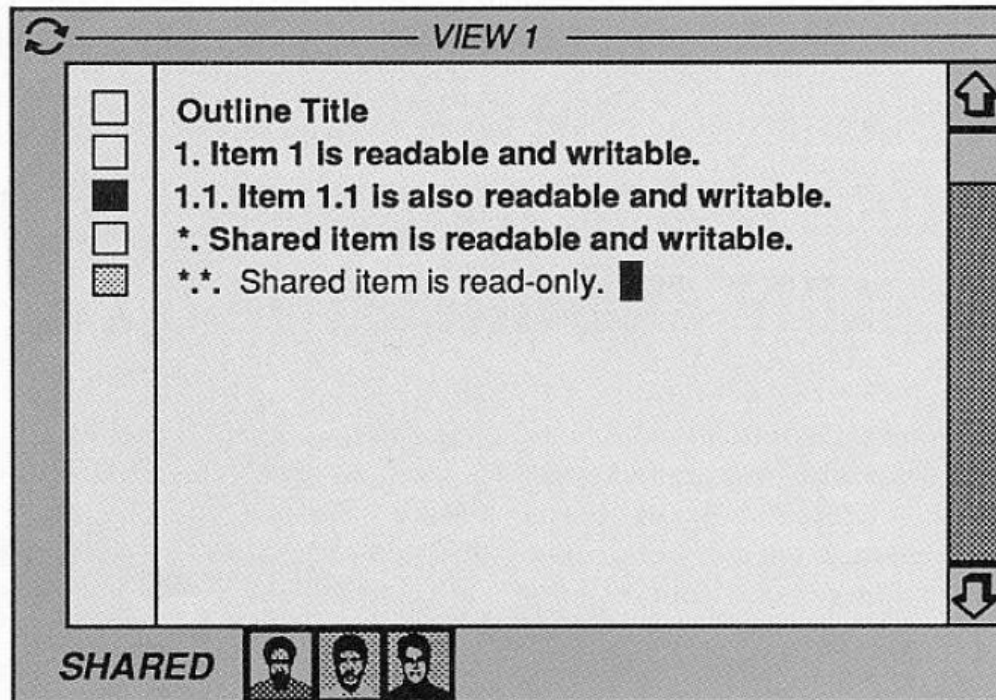
Clarence A. Ellis and Gary J. Nutt

- A programming language that can be **used by a Clerical worker**
- Software engineering – **modeling and validation**
- Operating Systems and database – distribution of data, **consistency and security**
- Measurement and Evaluation
- Communication - teleconferencing
- Other area – psychology, social implications

Collaborative Editor



- GROVE Group Editor



users ask “Isn’t it chaotic to all edit in the same document, even the same paragraph, at the same time?” and “Why would a group ever want to edit in the same line of text at the same time?” Indeed, this editor is at

Design issues (at the time)

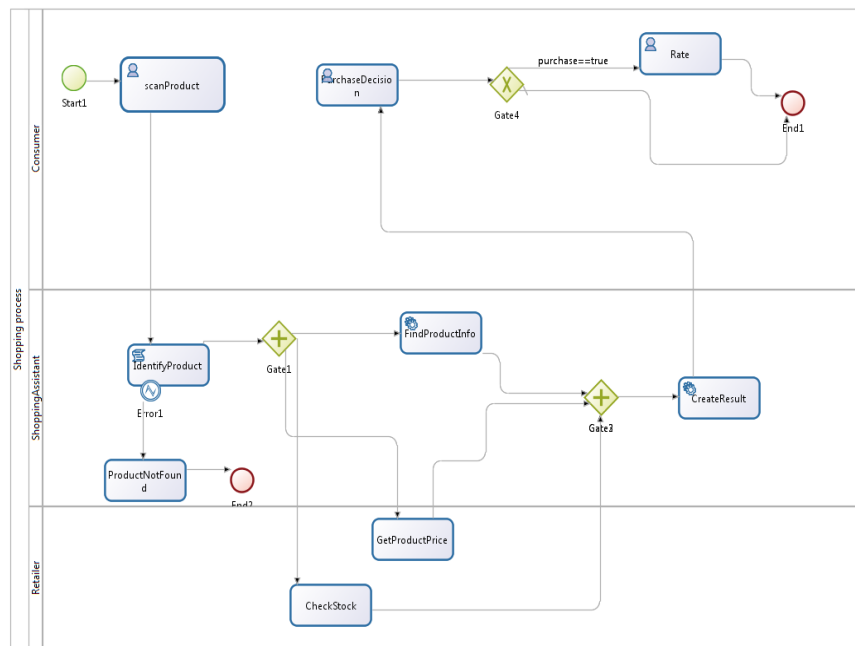
- WYSIWIS (What you see is what I see)
 - Relaxed vs strict
- Group Processes (Organising the collaboration)
- Concurrency Control (Optimist vs Pessimistic)
- Over issues



BPM systems



- Model and automate office processes
- Integrate Information Systems



Collaborative BPM

Social BPM



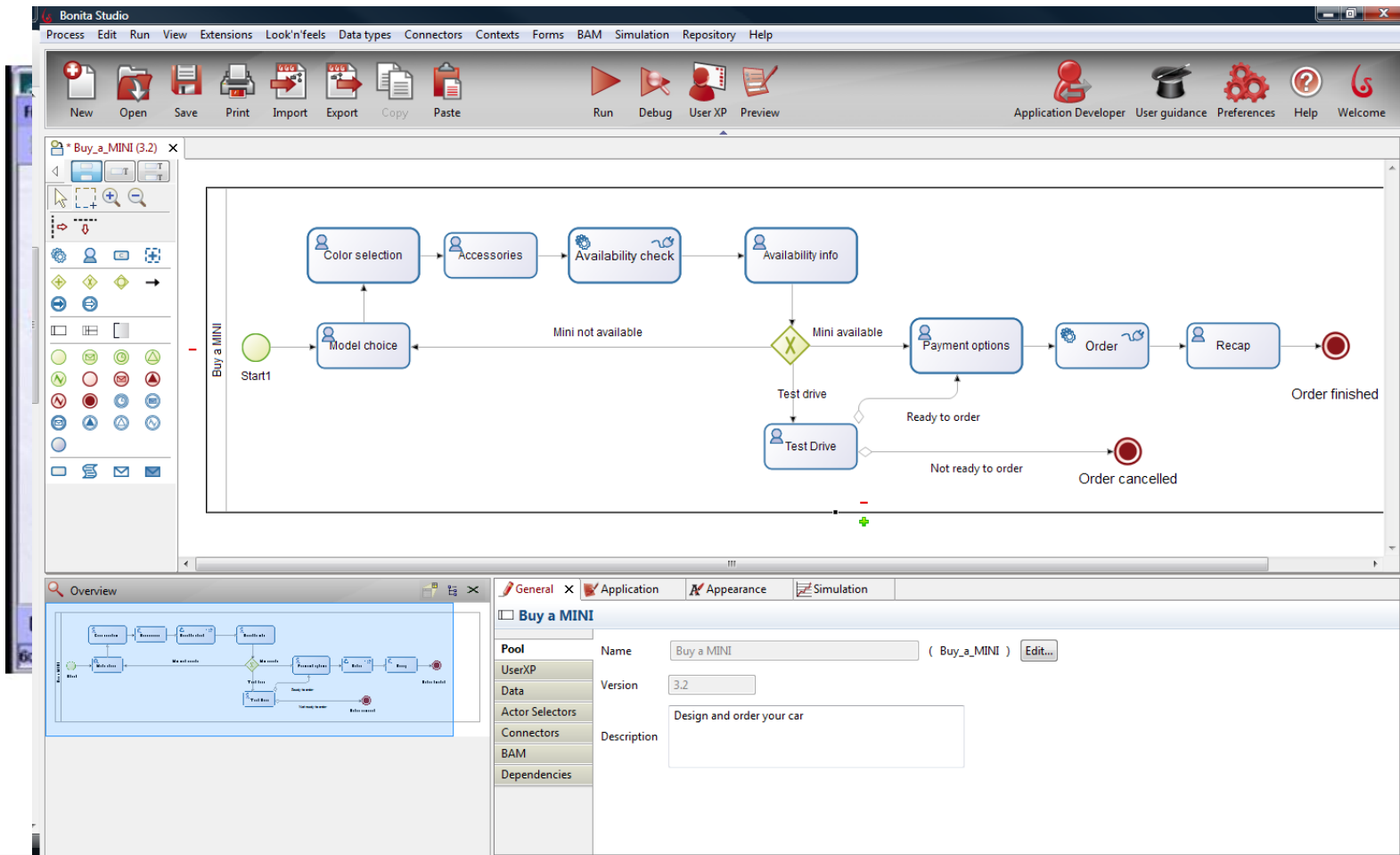
Support collaboration between people and organisations

More flexible/supports change

Allow more interactions between participant

Support for inter organisational process

BonitaBPM V6 (2015)



Inter organisational processes

The view-based approach to dynamic inter-organizational workflow cooperation

Issam Chebbi ^a, Schahram Dustdar ^{b,*}, Samir Tata ^a

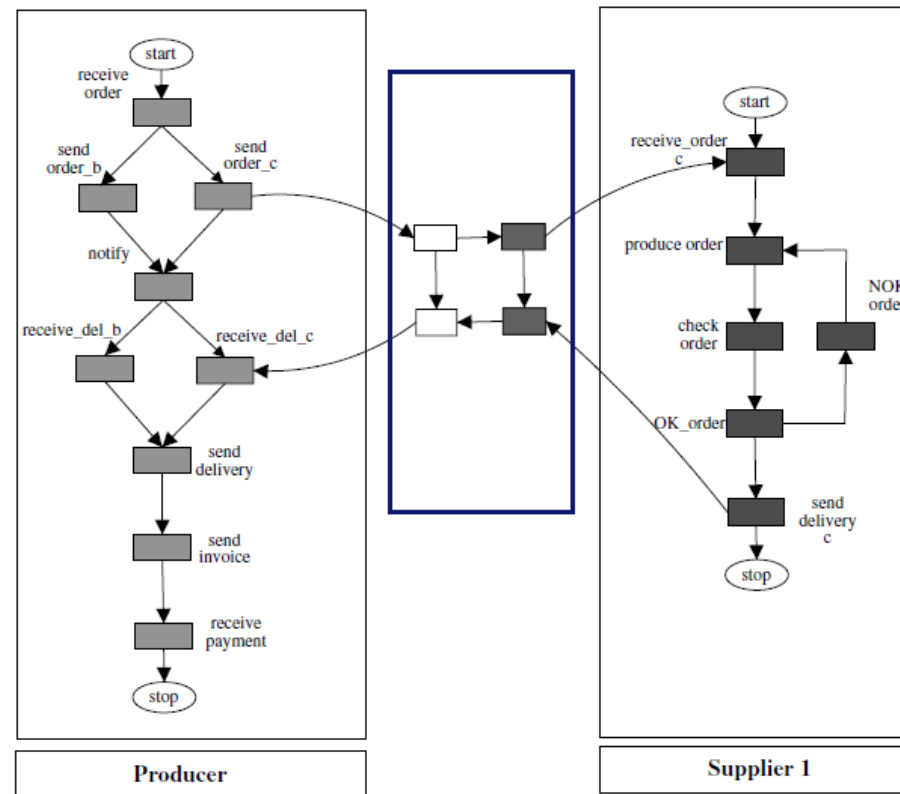


Fig. 4. Public vs. internal processes.

Coordination tool



AtomicOpenShift Roadmap

Epic Backlog

- Seamless Developer Experience on OpenShift (seamless-devexp) [9/34]
- Integrated CI / CD Workflows to Enable DevOps (ci-cd-workflows) [1/12]
- Mobile Services (mobile)
- Cluster Scale (cluster-scale) [4/12]
- Container Security (container-security) [1/3]
- Service Catalog (catalog) [1/6]
- Enterprise Image Registry (atomic-registry) [2/14/46]
- Cluster Automation and Infrastructure Integration (automated-provisioning)
- Simple Install & Getting Started Experience for Admins and Developers (simple-install) [0/15]
- Signing Images (signing-images) [3/10]
- Scanning Images and Containers

Done (3.2)

- Seamless Developer Experience on OpenShift (seamless-devexp) [6/6]
- Integrated CI / CD Workflows to Enable DevOps (ci-cd-workflows) [6/6]
- Container Security (container-security) [2/2]
- Enterprise Image Registry (atomic-registry) [11/11]
- Simple Install & Getting Started Experience for Admins and Developers (simple-install) [1/1]

Done (3.1)

- Grow the software ecosystem of components that can deploy on OpenShift [6/6]
- Provide language runtimes and key app components for OpenShift developers [5/5]
- Easily build application source code into deployable artifacts and integrate external CI/CD systems into OpenShift [17/17]
- Easily manage deployed images at scale and provide integration with existing Docker workflows [1/1]
- Creating, Templating, and Reusing Application Definitions [2/2]
- Jenkins (CI) Improvements [5/5]
- Infrastructure and Application Security [9/9]
- Expose centralized metrics capabilities to application administrators

Done (3.0)

- Grow the software ecosystem of components that can deploy on OpenShift [imagecov3] [10/10]
- Allow applications to get access to scalable and available databases [scalabledbv3] [1/1]
- Limit and monitor the resources consumed by teams and individuals within OpenShift [quotav3] [8/8]
- Application source control hosting and integration [scmv3] [4/4]
- Improve initial install experience for users on OpenShift Origin and reduce points of friction in development [installv3] [7/7]
- Creating, Templating, and Reusing Application Definitions [compositionv3] [4/4]
- Improve management and monitoring capabilities for OpenShift Administrators [adminv3] [11/11]
- Organization and Account Management [managev3]

Done (2.x)

- Deployment of applications can be controlled across multiple datacenters/geographies [geov] [3/3]
- Improve the development experience for individual stacks and frameworks [devexpv22] [5/5]
- Improve multi-user collaboration OpenShift via user groups and based access controls [teamv2] [3/3]
- New cartridges and updated versions of packaged software in existing cartridges within OpenShift [car] [4/4]
- Support multiple side-by-side deployments of OpenShift [multinstv22] [4/4]
- Improve multi-user collaboration OpenShift via user groups and based access controls [teamv2] [11/11]
- Improved management for Log and Metrics [metricsv21] [13/13]
- Deployment of applications can be controlled across multiple datacenters/geographies [geov] [2/2]

Menu

BB, EP, LXIA, MP, RAJAT, RP, PW, TR

Show fewer members

Filter Cards

More

Activity

- Dan McPherson moved [Improvements for JBoss and Java application development \[javav21\]](#) from Epic Backlog to Done May 21, 2014 at 5:03 PM
- Dan McPherson moved [Improve the development experience for individual stacks and frameworks \[devexpv21\]](#) from Epic Backlog to Done May 21, 2014 at 5:03 PM
- Dan McPherson removed Future Scenarios from [Improvements for JBoss and Java application development \[javav21\]](#) May 21, 2014 at 5:03 PM
- Dan McPherson removed Future Scenarios from [Improve the development experience for individual stacks and frameworks \[devexpv21\]](#) May 21, 2014 at 5:00 PM

Trello used by OpenShift

Data sharing and collaborative editing

- Version and Distributed version control Systems
- Wiki
- Synchronous collaborative editors
- File Sharing

Version Control Systems and File sharing



- CVS, SVN, Git, ...



OneDrive
for Business



Google Drive for Work



amazon WorkDocs



Dropbox

Workspace Awareness



- What are the other doing

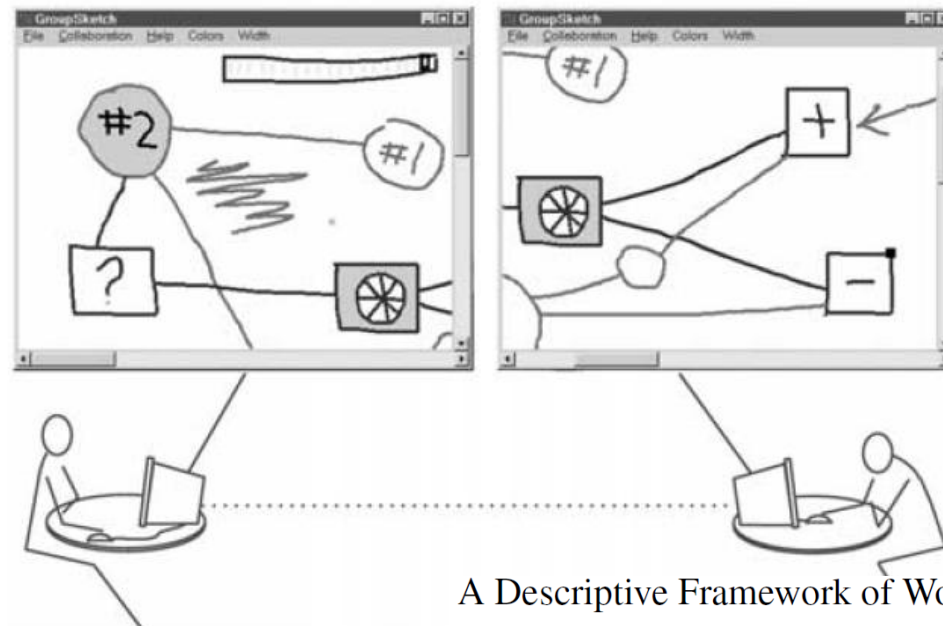


Figure 1. GroupSketchpad, a rel

A Descriptive Framework of Workspace Awareness
for Real-Time Groupware

CARL GUTWIN¹ & SAUL GREENBERG²

Example : the Radar view



- Where are the other – what are they doing

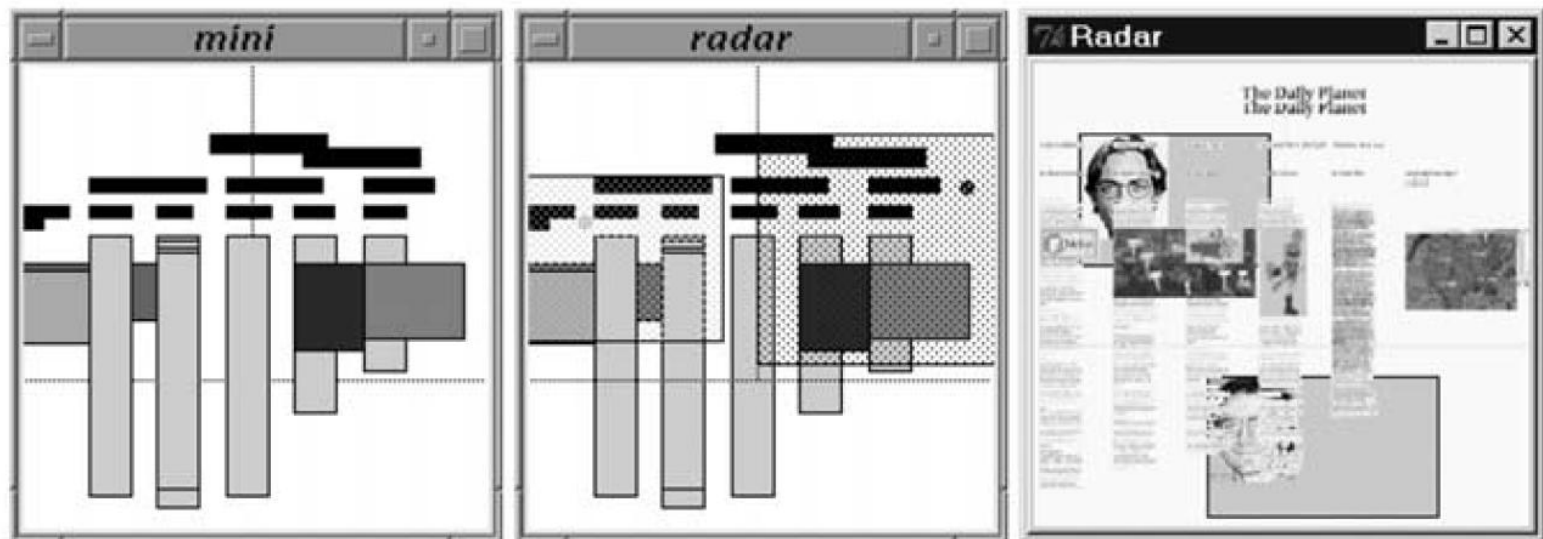


Figure 4. Three versions of the GroupKit radar view. Version 4a shows object movement only; 4b adds location information by showing each person's main view as a shaded rectangle; 4c adds photographs for participant identification.

Real time collaborative editing



Maintaining replicas in real time

Ensure eventual consistency

Take care of user intention

Google Doc/EtherPad

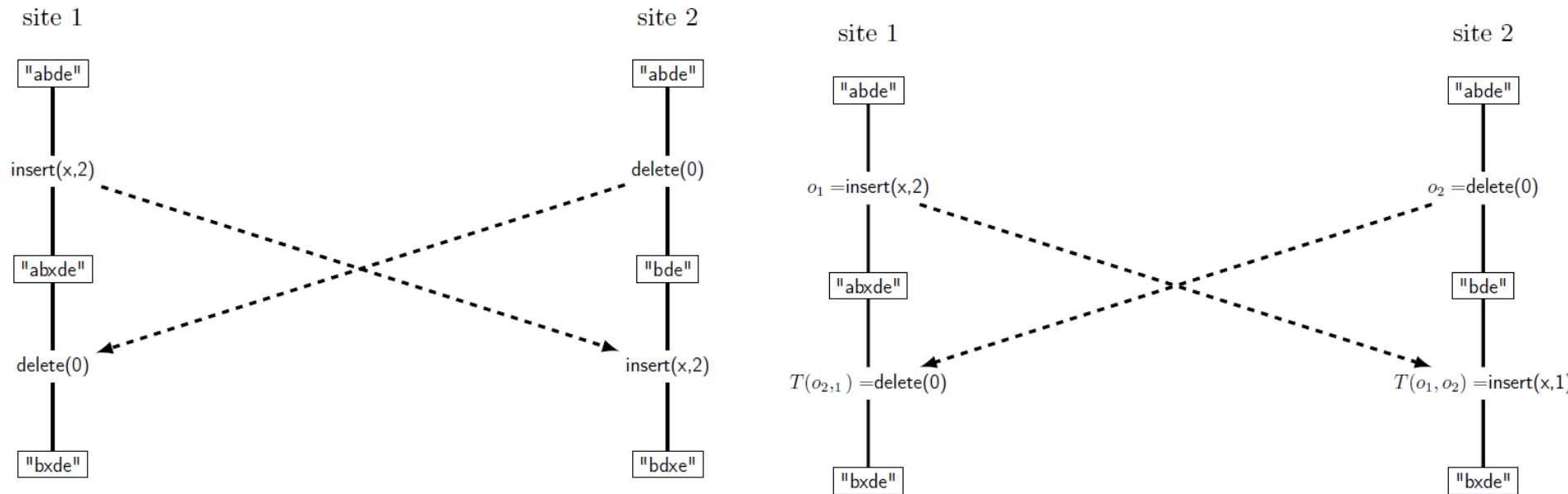
Writing workshop on Framapad

The screenshot shows the Framapad web interface. At the top, it says 'Hébergé par Bearstech' and 'Framapad (limites)'. The title of the document is 'poieo 4.8'. There is a timestamp '01/26/2015 18:55:43' and a status bar indicating 'poieo 4.8 Version 645 Saved Jan 26, 2015'. The main text area contains a collaborative writing session with various lines of text, some highlighted in different colors (yellow, red, green, blue). The text includes phrases like 'Où Est-ce que la Loire-Atlantique fait partie de la Bretagne?', 'Au même endroit mais de l'autre côté de la route les premières lunettes 3D en carton vieux stylo cassé utilise comme carabine', 'Panneau zone 30', 'Zone 70 (encore)', 'En arrivant au STOP à ma droite le panneau de publicité « Auberge de La Coudre » avec le numéro', 'Je marche, c'est chiant, et je ne suis pas prête d'arriver ! 20 minutes à pied. Ou plus !', 'Il était une fois la pièce du puzzle qui réussit à réunir la France, petit pays d'Europe. Etrange paradoxe.', 'Un bar au coin de cette rue, un autre au bout de celle-ci. Une église au bout de cette rue, une autre au bout de celle-ci. Des touristes, des touristes, des touristes, brandissant leurs appareils photos.', 'J'habite dans une maison d'un quartier d'une petite ville, la ville est une cuvette. Ce pays de vaches !', 'J'habite une autre maison qui paraît très petite, une maison qui bouge toujours avec moi.', 'Tous uniques mais finissant comme des « moutons ».', 'Je suis un élément. Un élément d'une liste très organisée. Et puis si on cherche un peu, on tombe aussi sur des blogs de pâtisseries et de mode.', 'Une réussite sociale à première vue. Céline Dion.', 'Un numéro quelconque, numéro 4.', 'Et si on cherche un peu, il n'y a pas tant de personnes qui sont connues (Edgar Allan Poe, Quentin Tarantino, Roger Federer, Tim Burton).', 'Puis je descends par la cour du collège pour enfin arriver dans la cour du lycée. C'est alors que j'ai sombré.', 'Que l'oubli m'a englouti. Je me suis noyée. Je devais avoir 10 ans. Je devais avoir 10 ans. Je devais avoir 10 ans. c'était sans doute en 2006.', 'Je me souviens avoir eu mon premier ordinateur en CM1 ou en CM2, gros écran et centrale, ordinateur beige mais pas du moment où l'on a du le jeter, sûrement pendant ma 6ème.', 'Brusque changement de direction. D753 et tout d'un coup c'est beaucoup plus plat.', 'Peu important les noms, peu important les personnages, car elle est chacun d'eux.', 'Peu importe l'auteur, car seul importe son œuvre.', 'C'est quoi un rêve?', 'Rêver c'est important, plus important que d'attendre le métro.', 'Il y a Carnac en Bretagne, avec sa plage et sa nature. Il y a Nairobi, au Kenya, avec ses parcs et ses grandes étendues solitaires. Il y a Bombay, en Inde, et sa culture magique. Il y a le Machu Picchu, et ses montagnes splendides. Il y a Palerme en Sicile, et son histoire passionnante.', 'Bonjour, dégustation de melon. Et pâtisseries Choses qui ont une grâce raffinée. C'est comme les bigorneaux !!!', 'Sur place ou à emporter?', 'C'est une affaire sérieuse, ça vous suit toute une vie. Mais quel rapport avec les questions précédentes ? Plein de mystères.', 'STOP !! N'importe quoi. Je vais pas manger ça. C'est pas la saison.'

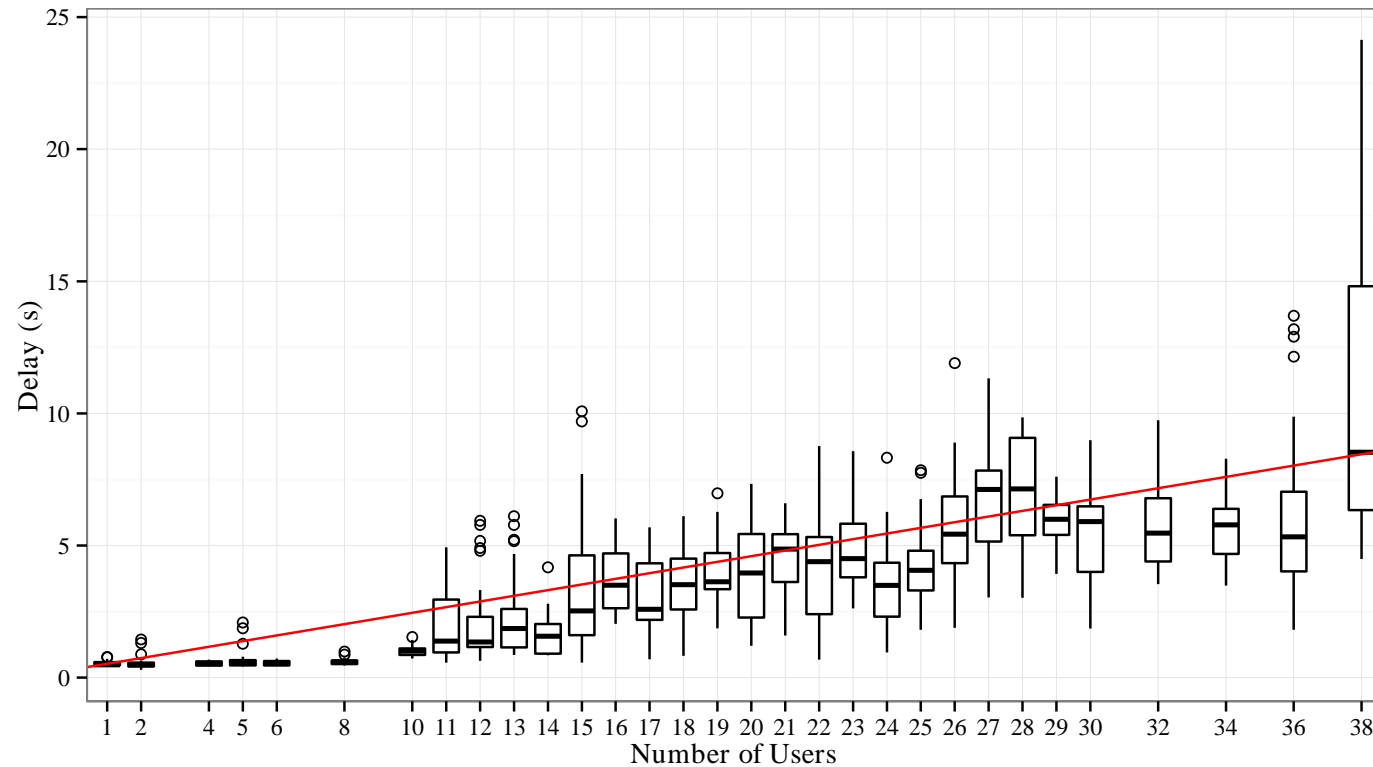
<https://vimeo.com/117890611>

Operational Transformation

Enforce eventual consistency



Delays in GoogleDocs



Typing speed:
2 chars/sec

Conflicts management



How to avoid them when the number of users grows

1 40 ans d'interaction homme-machine : points de repère et perspectives
2 Depuis qu'il existe les ordinateurs, la question de l'interface avec les utilisateurs s'est posée. En quarante ans, l'interaction homme-machine (IHM) a permis de rendre l'informatique accessible à un plus grand nombre, d'une façon que nul ne pouvait prédire. Que serait le visage de l'informatique aujourd'hui sans les interfaces graphiques ?
3

pouvais

interfasses

1 40 ans d'interaction homme-machine : points de repère et perspectives
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3

pouvait

interfacces

What about today's topic



About Large SCALE

- Hundreds or thousands of people
 - Crowds, communities, social networks
- Hundreds of organisations
- Thousands of services

Large scale collaborative editing

users ask “Isn’t it chaotic to all edit in the same document, even the same paragraph, at the same time?” and “Why would a group ever want to edit in the same line of text at the same time?” Indeed, this editor is at

Pad strasbourg nuit debout



More than 70 participants

17/04/2016 23:10:22

Version 23979 Enregistré le 17 avril 2016

Auteurs : Alex, anonyme, Tiffany, Alex / Hackerspace, Vail, Hottel, lol, Mikael, G, Nath, Alice, Christoph, anonyme, viny, Martin, dimtriads, Hélène, Ben, Hay, Samien + 55 auteurs anonymes

Pour que les pads restent des outils fonctionnels, veuillez copier le plus rapidement possible les comptes rendus sur les pages wiki (ici pour vous : <https://wiki.nuitdeboutstrasbourg.tk/dokuwiki/doku.php?id=actions>)

Veillez à ce que la mise en page soit propre et que ce soit corrigé et structuré.
Les pads pourront ainsi être réservés aux discussions plus techniques sur les actions à mener au sein de la branche.
Une fois un point résolu, vous pouvez le copier-coller en bas de page pour qu'il reste disponible en consultation d'archive ou bien l'effacer si ça n'a plus d'importance fonctionnelle. (ne déroutons pas les nouveaux venus avec trop de contenu non structuré.

Veillez également à afficher en dessous de ce message un bref résumé des objectifs principaux de la branche pour que les gens sachent comment interagir avec les autres.

Merci de laisser ce message en haut de page pour le moment

Agenda

- Lundi 18 avril - 8h30 - place Kléber : distribution de café et/ou de petit dej place Kléber
info : <https://strasbourg.nuitdebout.fr/pad/p/distribCaf%C3%A9>
Apporter, thermos, gobelets, thé, eau chaude, sucre, carton, feutres, prospectus ...
- mardi 19 avril - 18h - à république : atelier "voix" suivi ou complété de "techniques de prise de parole"
- "voix" pour ne pas se casser la voix pendant la manifestation du lendemain
- techniques de prise de parole pour parler devant un auditoire, une caméra, un journaliste ...
- mercredi 20 - 14h - Place Kléber : manifestation contre la loi travail à l'initiative des étudiants
Départ Place Kléber, arrivée place de la Rep.
- jeudi 21 - 17h30 - place Kléber : distribution de café <https://strasbourg.nuitdebout.fr/pad/p/distribCaf%C3%A9>
- vendredi 22 - 11h30 - marché à Cronenbourg : Tractes et contacte avec les habitants à côté du CNRS
- Samedi 23 après-midi : ateliers : la loi travail - logement - monnaie locale Le Stück
- mercredi 27 midi : intervention devant l'ENA pour dialogues et interview, en préparation

<https://wiki.nuitdeboutstrasbourg.tk/dokuwiki/doku.php?id=actions> Consultations en ligne

Bienvenues sur le pad du groupe Actions !

N'oubliez pas de faire remonter vos comptes rendus les ami-e-s ... surtout de votre groupe !

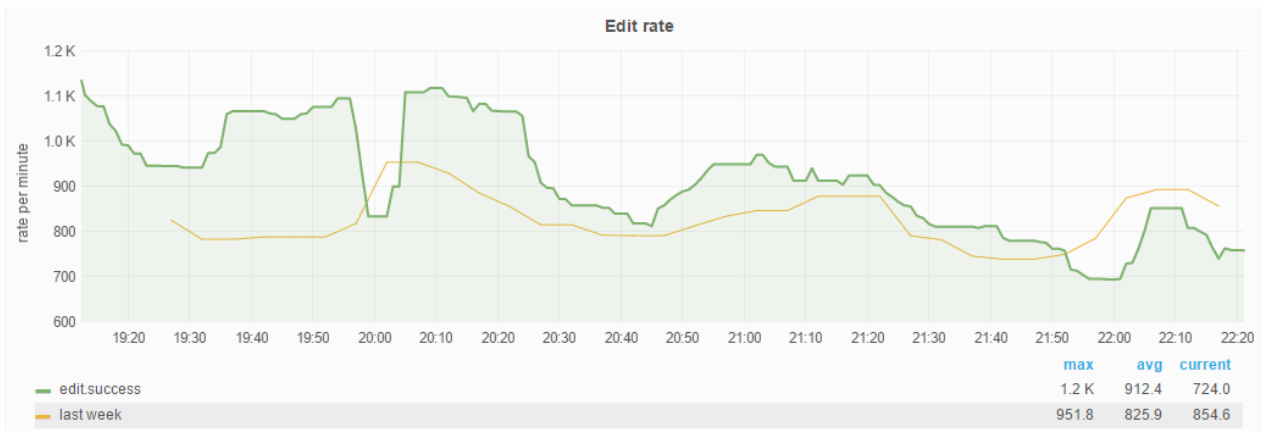
Samedi 16 avril :

- Lundi 18 avril 8h30 : distribution de café et/ou de petit dej place Kléber
pad dédié aux futures distribution de café : <https://strasbourg.nuitdebout.fr/pad/p/distribCaf%C3%A9> Concernant ce lien, ou le trouve-t-on mis à part ici ? pas forcément facile d'y accéder pour les personnes voulant se greffer sur l'action en effet.
Besoin de gobelets ?
- mardi 19 - 18h à république : atelier "voix" pour ne pas se casser la voix pendant la manifestation du lendemain

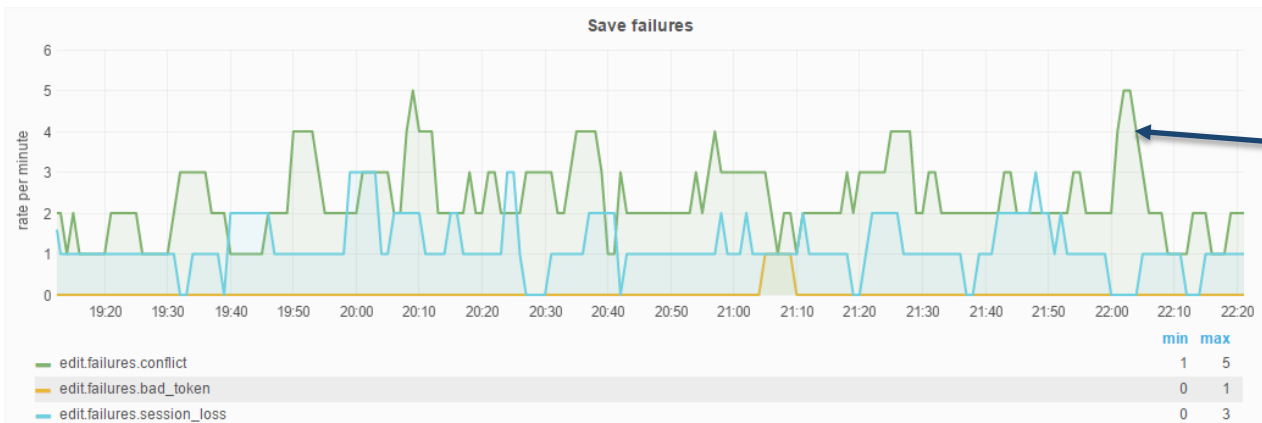
<https://strasbourg.nuitdebout.fr/pad/p/Actions/timeslider#23979>

Írta

Wikipedia edit conflicts



900 edit/mn



5 failure conflict/mn

<https://grafana.wikimedia.org/dashboard/db/edit-count>

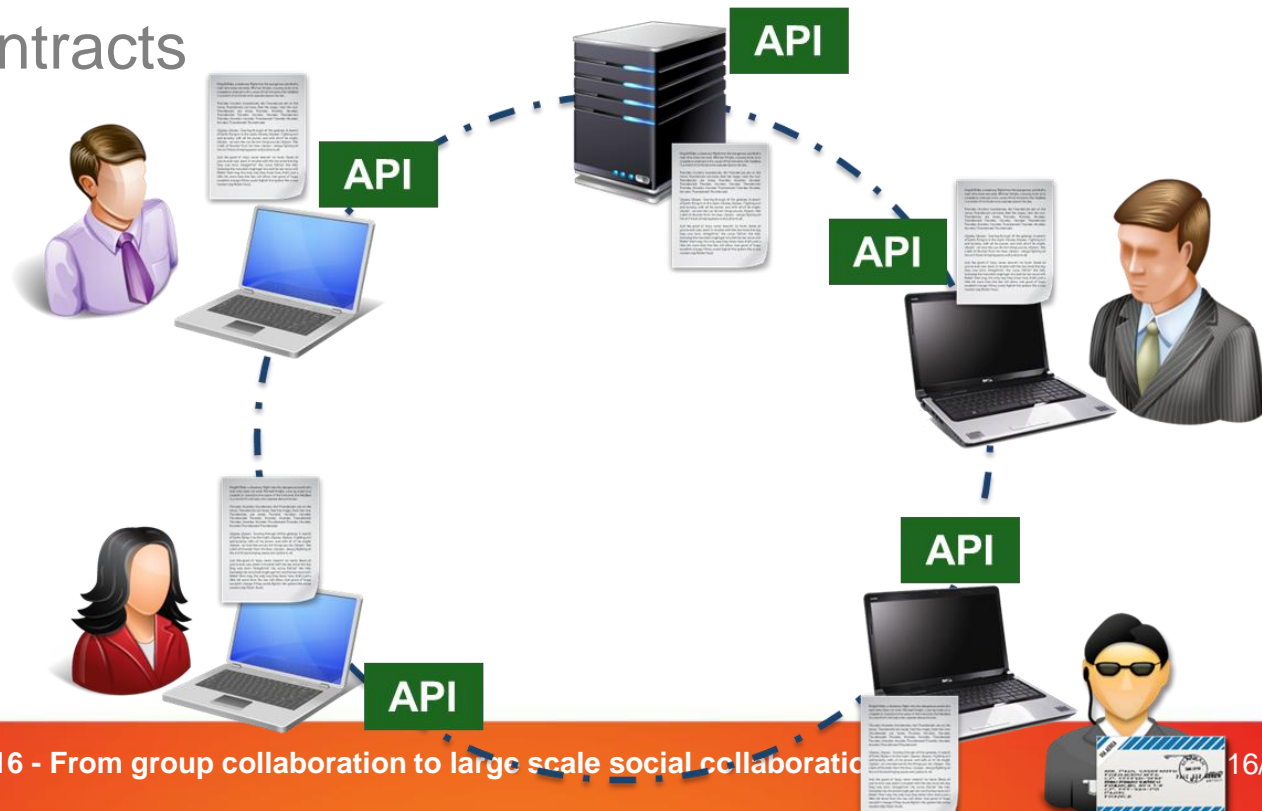
Centralized architecture ?



Abstract/Configurable p2p architecture



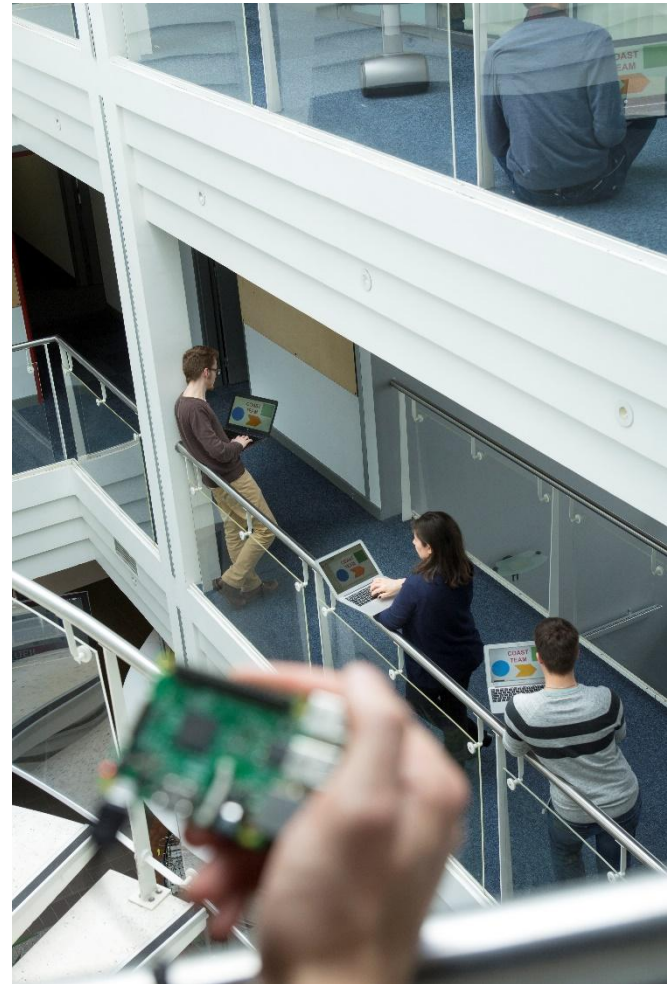
- Each partner decides of the control and of the contracts



MUTE v2 – No central server

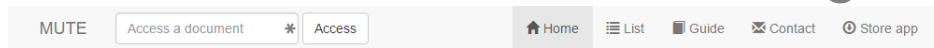


Photos Christian Morel



The Mute P2P editor

- Based on CRDT Algorithm (LogootSplit)

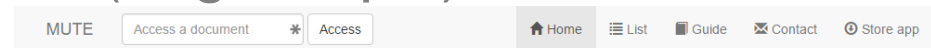
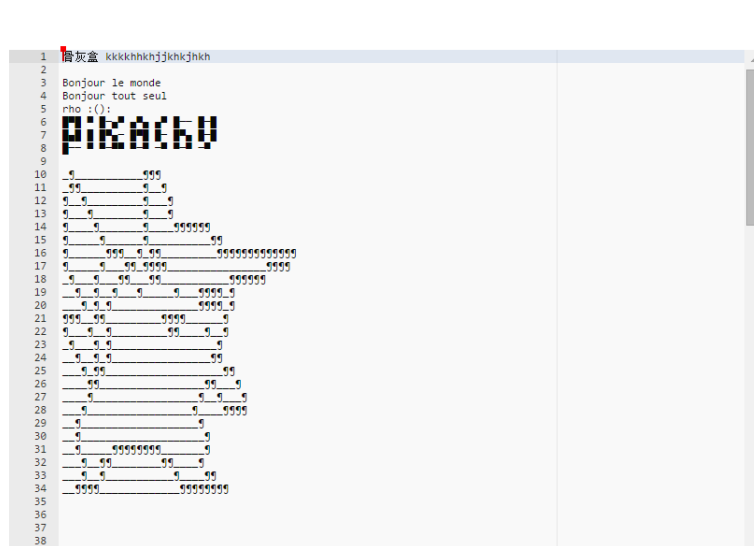


Try MUTE, the Multi-User Text Editor

Switch to history mode

Switch to offline mode

Online!



Try MUTE, the Multi-User Text Editor

Switch to history mode

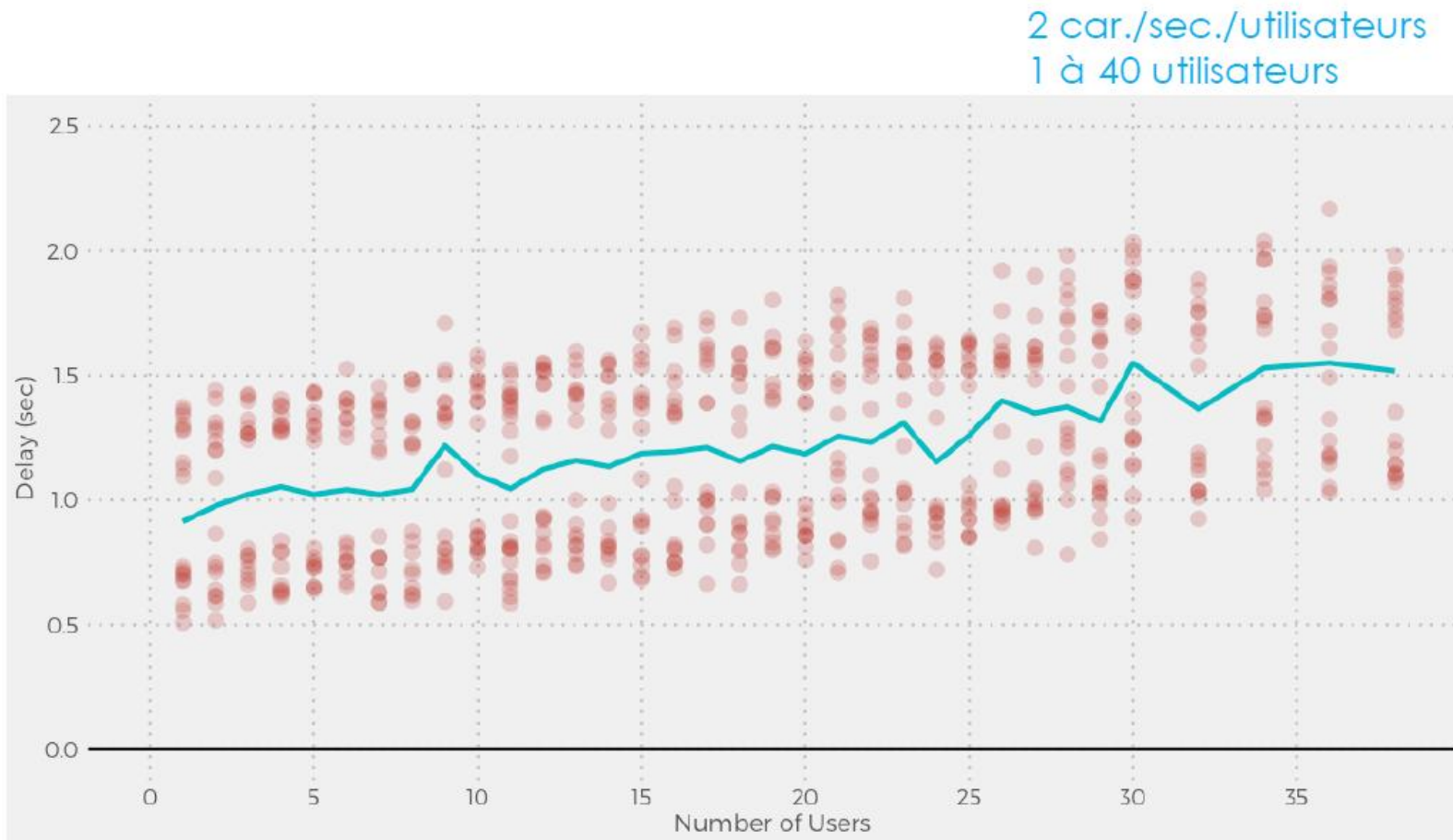
Switch to online mode

Offline!



<http://mute-collabedition.rhcloud.com/doc/wetice2016>

Delays in MUTE



Who is doing what ?



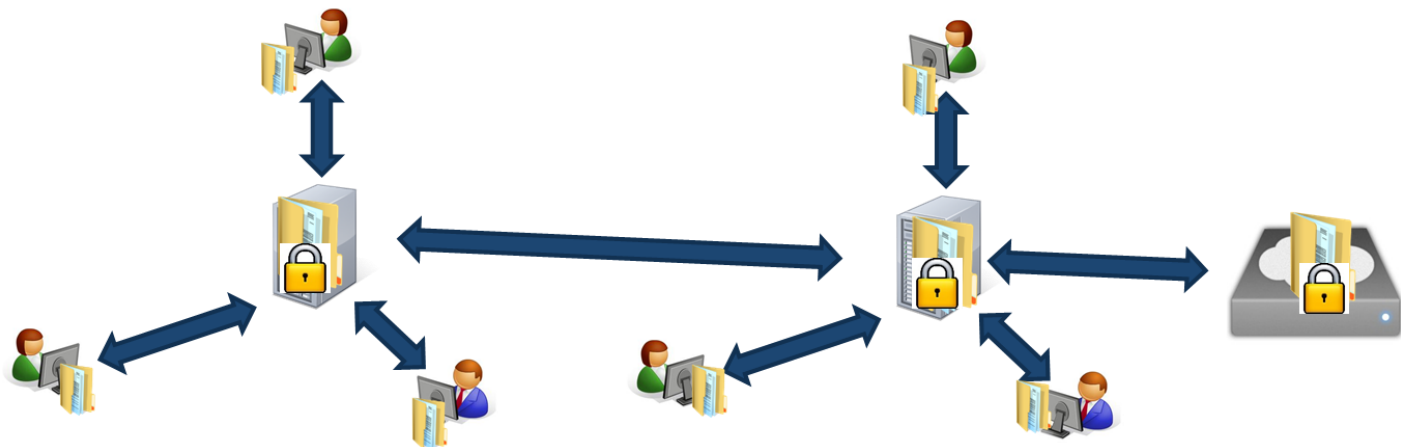
- Awareness at a large scale



A complex challenge : security and trust

- Who are the people I'm working with
- Collaboration data can be encrypted and not shared on the cloud (being investigated).
- Provides guarantees to the participants

Current Issue





Coordination at a large scale

Haiti Earthquake 2006

- 7.0 Magnitude earthquake – 3.5M people affected – 220.000 death (est.)
- **Hundreds** of responding organisations



Unexpected event at an unexpected scale

- First responder : people
- Overwhelming answer from the international community (hundreds of NGO's)
- First important use of social network
- volunteer based crisis mapping
- <http://www.digital-humanitarians.com/>

Hurricane Katrina 2005

- Category 5 Hurricane
- Caused breaches to flood protections structures
- 80% of the city of New Orleans Submerged (1500 deaths)



Coordination issues

- Very wide area affected
- Several political decisions level
- Coordination issues during the evacuation

The Danube floods

- 2002,2005,2006,...,2014
- Very common event – cross international borders
- Requires a dedicated organisation



Coordination at a large scale

- Combination of human and services activities
- Composition of hundred of services
- Duration, kind of contribution, governance
- Various domains : logistic, crisis management, software development,

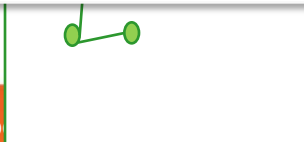
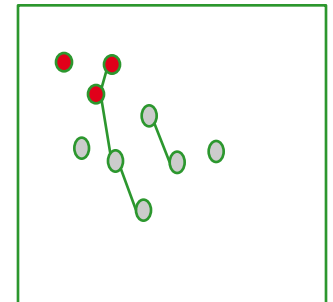
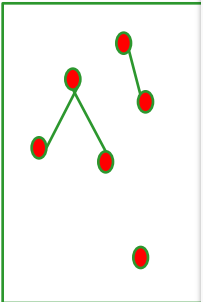
Inter organisational issues



“we are exchanging text information real-time through either cell or mobile units or satellite”

[..]

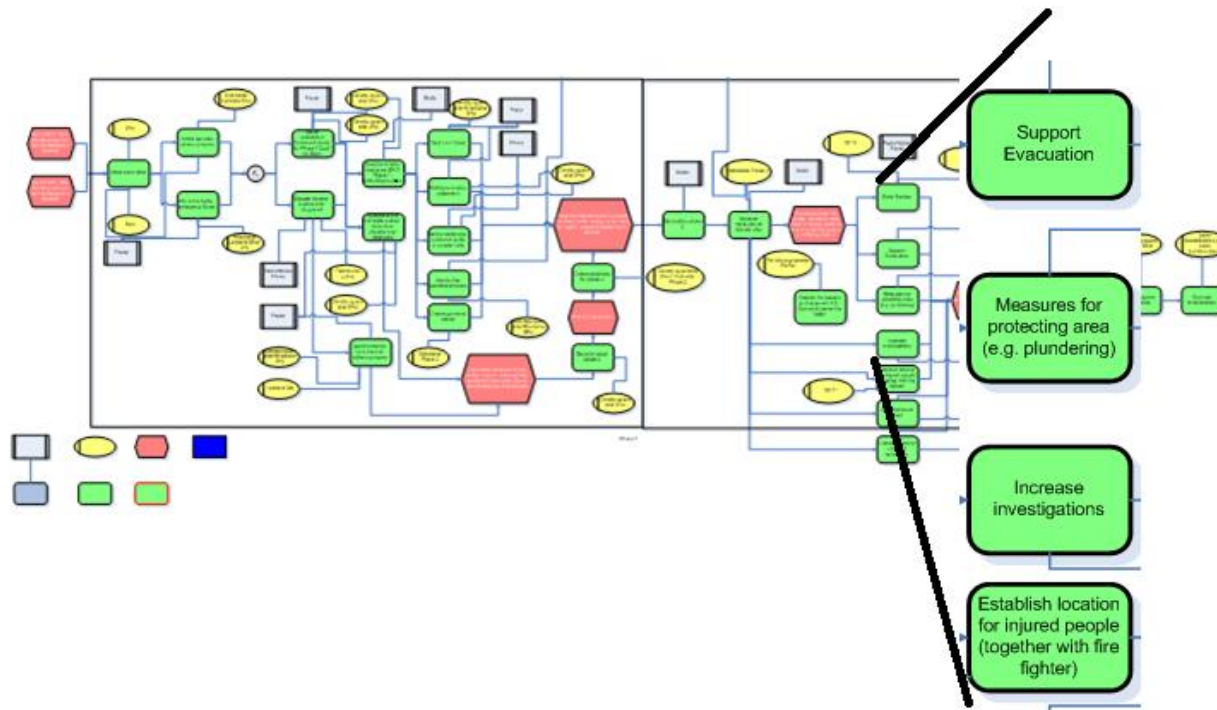
“obvious the more complex a situation gets, for instance where you may have many organizations working collectively in order to accomplish a goal, but at the same time working independently in terms of their own interests, where you get in those in situation like that, you know it get to the point, to be so complex that it would be overwhelming”



Complex BP Modeling



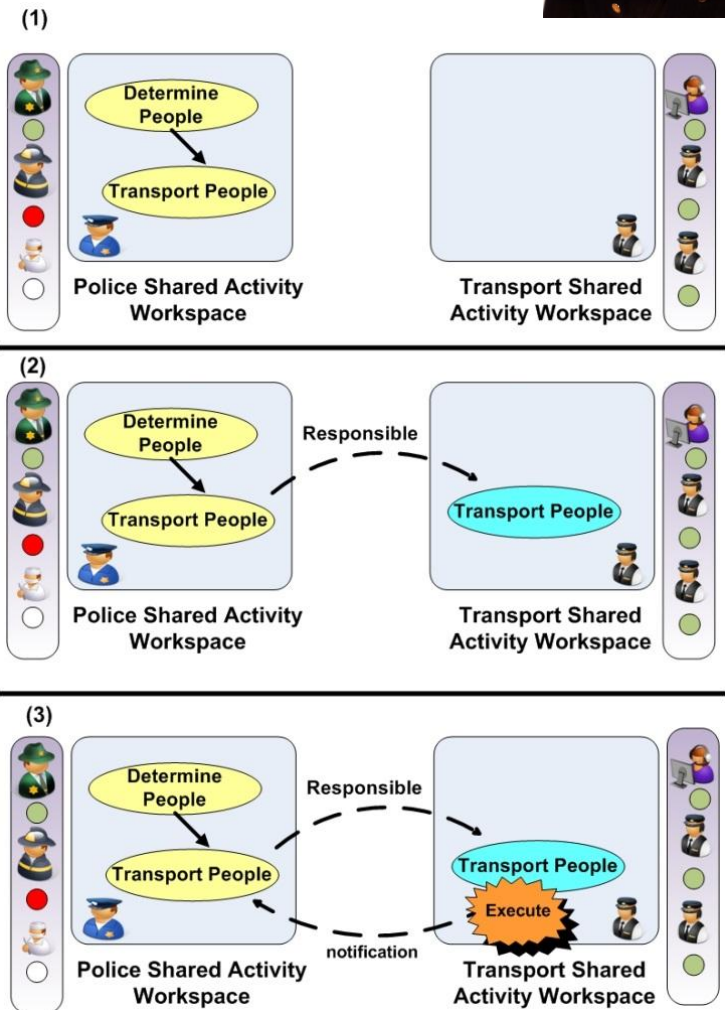
- Outcome of a workshop with Firefighters



Coordination awareness



- Activity awareness ?
- Coordination **without** a central authority
- Distribution of control
- Privacy



Crowdsourcing

Coordinating very large scale/long running simple activities

Combining human task and service in a process at a large scale

Centralised process with very distributed unknown performers

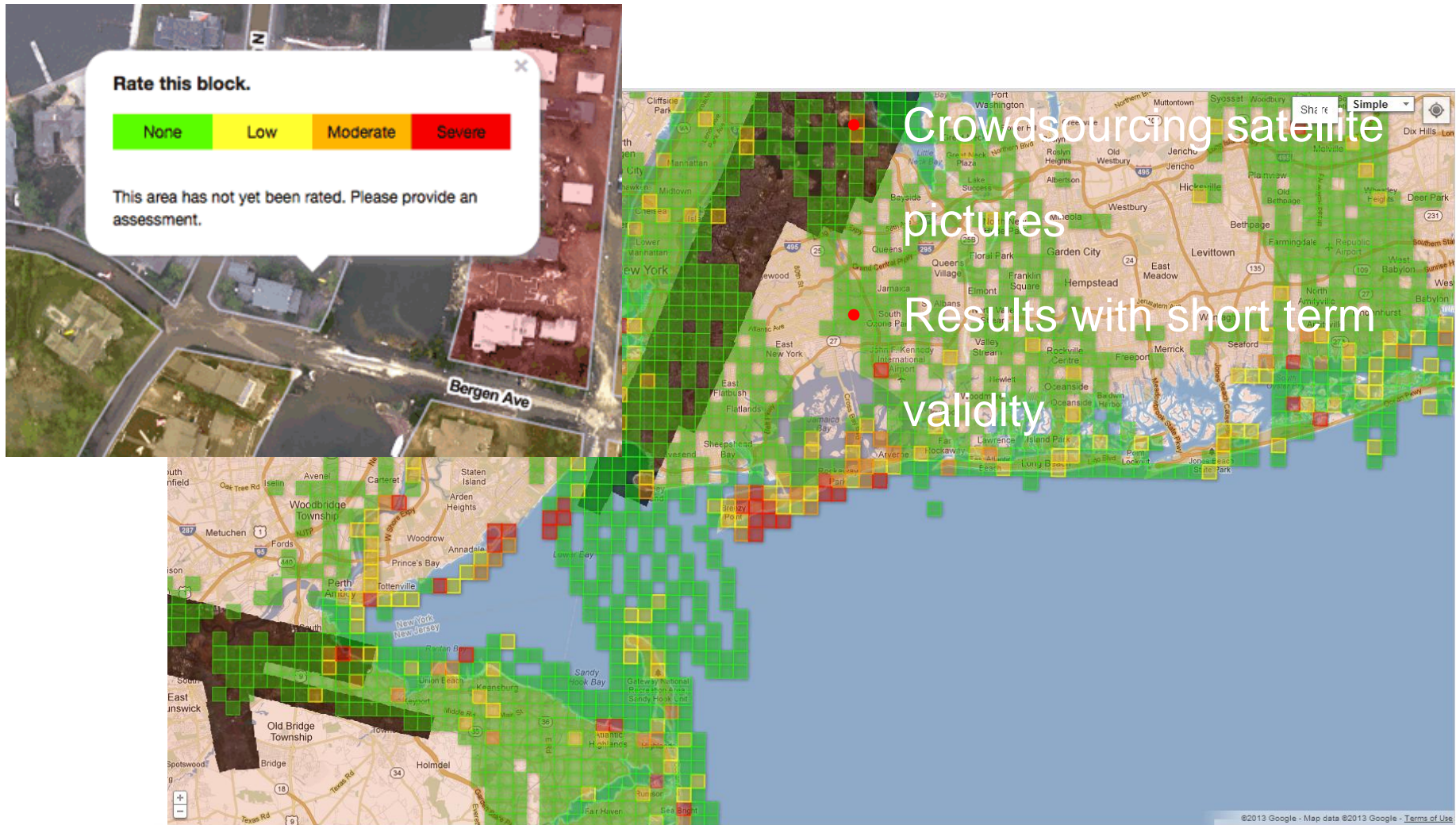
Haiti Crisis Mapping

4636 project volunteers translated 25,186 SMS messages and numerous e-mail, Web, and social media communications, resulting in 3,596 reports that were actionable and included enough relevant information to be mapped on Ushahidi.³¹



The Fletcher Crisis Mappers at work in Boston. Photo courtesy of Carol Waters.

Sandy Damage Assessment (2012)



Google Crisis Response - How are you using this map? Tell us - Help

Industrialisation of crowdsourcing



(a) Transcribe receipt

The Foodman Cafe
250 Walnut Street
Englewood, NJ 07631
201-568-8056

08/07/2010 9:30AM CHECK NO: 01001
TABLE: A PERSONS: 02
SERVER: BERT

Qty		Price
1	Foodman Burger/ Medium Rare/Onions/ Lettuce/French Fries	15.00
1	Ginger Ale	1.50
1	Diet 7-Up	1.40
1	Cappuccino	2.00
1	Chec Rasp. Truffles	1.50
1	Grilled Chicken/ Beefsteak /onatoes/ Bacon/French Bread	7.95
	Subtotal >>	29.35
	Tax >>	2.42
	Pay this Amount >>	31.77

Use these two lines for advertisements,
special announcements, etc.

Company name

Address

Date

Total

(b) Check and improve

Happy Food Company
Customer Copy

1/2/2008 9:45:36 PM
Store Location
Store City : Store State Store Zipcode
Store Country
TEL: (408) 476-8754

Employee : vincent
StoreID : store1
SystemID : POS 2
Pay By : CASH

#	Desc	Qty	Price
2	DVD Spiral Tap	2	\$54.00 Y
4	Internet Manager	2	\$50.00 Y

***** INVOICE *****
447

Subtotal : \$114.00
Tax : \$9.45 (8.25%)
Total : \$123.45

CASH payment : \$300.00
Total Item Sold : 4

Change Due : \$176.55

Company name

Address

Date

Total

(c) Classify receipt

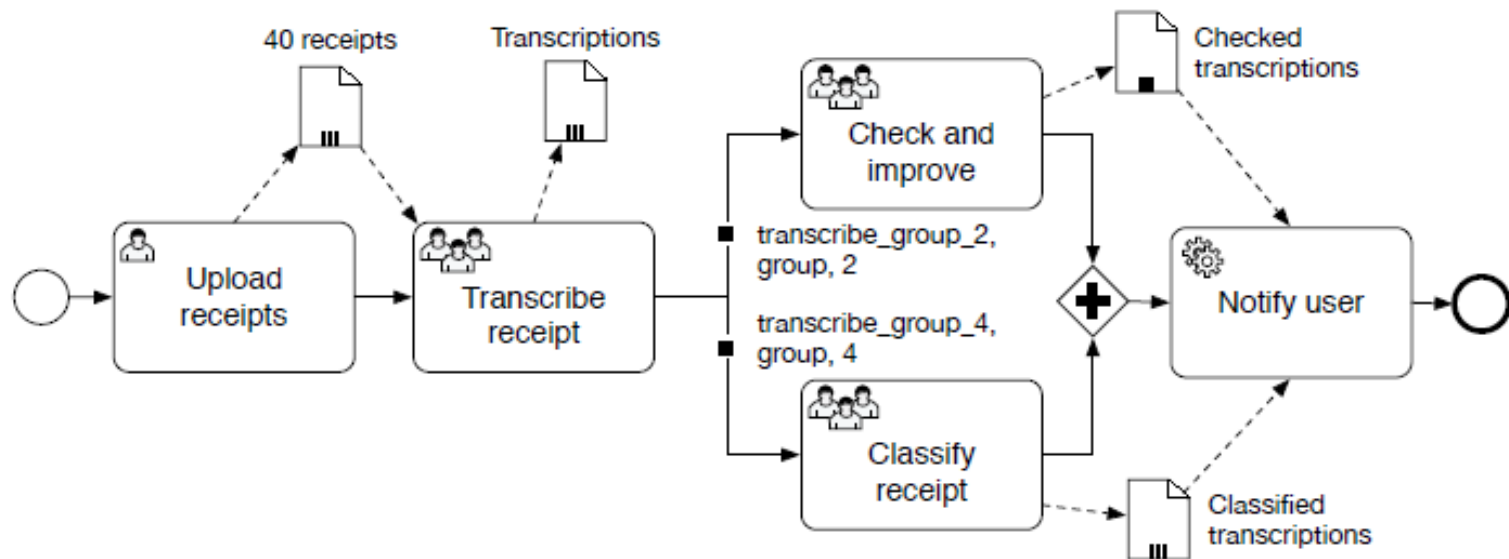
Spending type

- ☐ Transportation
- ☐ Accommodation
- ☐ Meal
- ☐ Other

BPMN Task Instance Streaming for
Efficient Micro-Task Crowdsourcing Processes

Stefano Tranquillini¹, Florian Daniel^{1,2}, Pavel Kucherbaev¹, and Fabio Casati¹

BPM for crowdsourcing



Large scale real time coordination

Unsolicited individual data

Collaborative data



Wikipedia 1500 edit to the main page between the 28 and the 30th of october, not mentioning the talk or the area related pages

Twitter– 35000 geolocalised tweet/day



Flickr – 3000 geolocalised photos/day

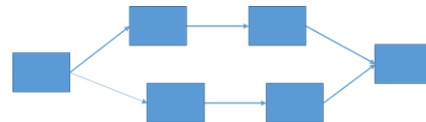


10 photos/s on instagram during sandy



Process

INPUTS



Computers

Crowd

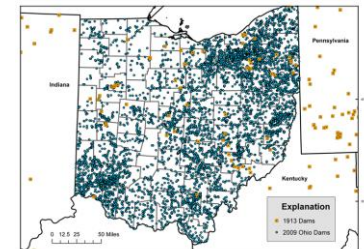
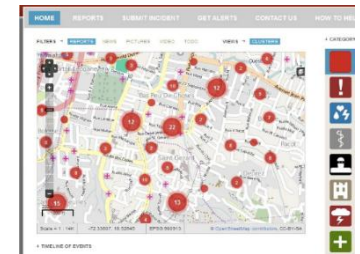
Experts

Citizen Sourcing Data

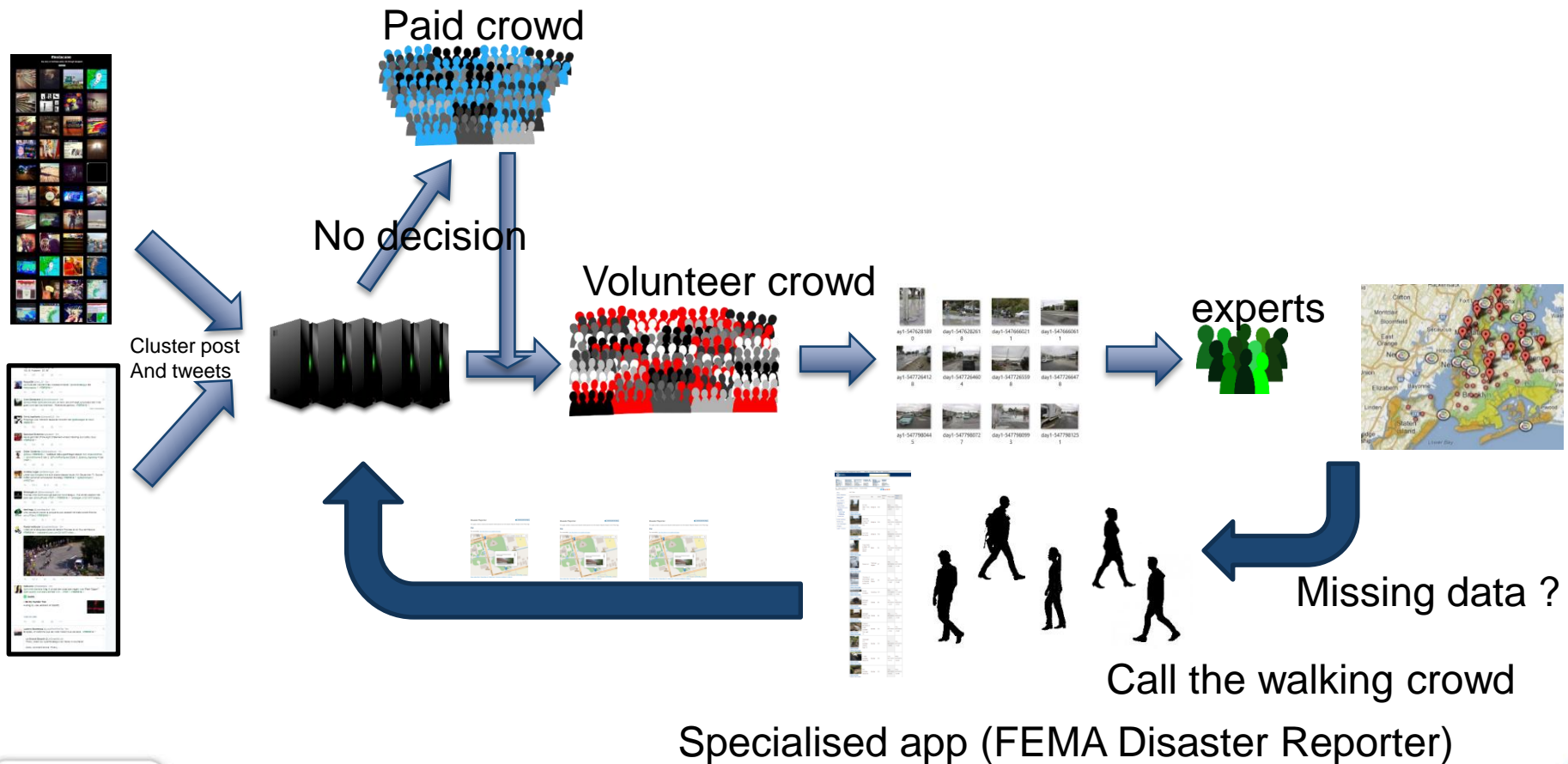


FEMA dedicated app

Dedicated app can receive notification and but used to ask for data



Human/Machine composition example



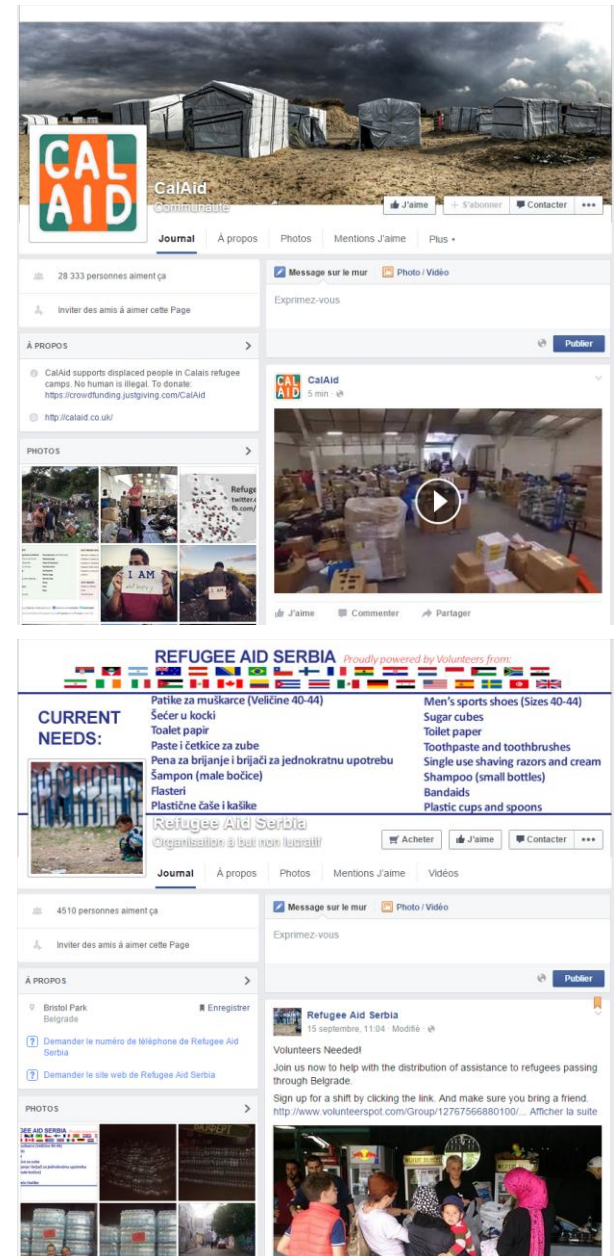
The Refugee crisis

- A very tricky kind of crisis
- Affect international relationships
- Difficult agreement on the response



Citizen coordination

- International scale
- Citizen create Facebook pages, maps, dedicated tools to coordinate
- But privacy, security, reliability, trust issues



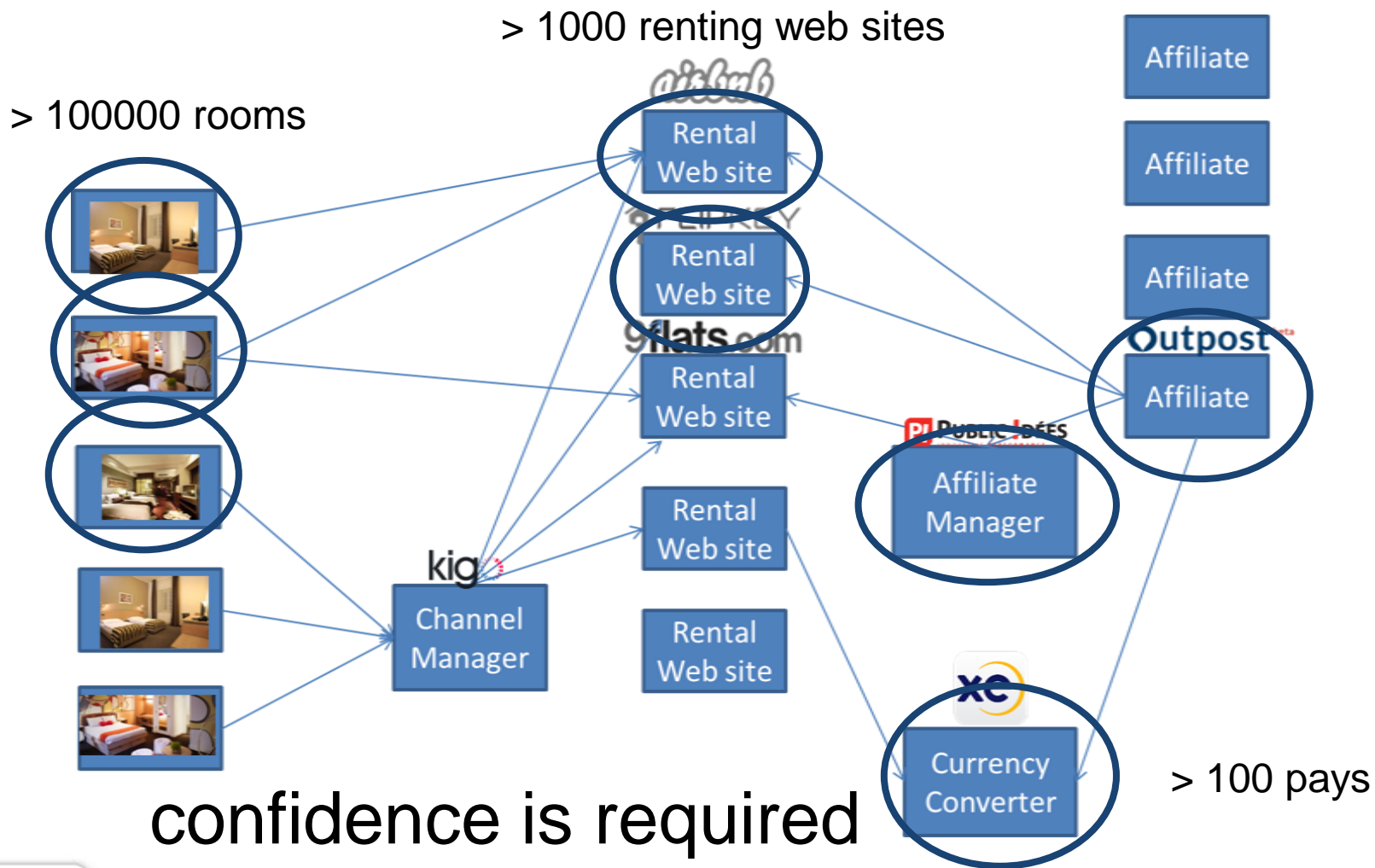
Internet wide service composition

The screenshot displays the Outpost website interface. The top navigation bar includes links for ACCOMMODATIONS, RIDESHARES, and EXPERIENCES, along with a currency selector set to EUR. A map of Florence is shown on the left, with a blue circle highlighting a cluster of location pins. On the right, three accommodation listings are displayed:

- Appartamento Oltrarno-Pitti: wifi internet** (HOUSE TRIP): €436 for 4 nights. Features: Apartment, Entire Place, Sleeps 2, 1 bedroom, 1 bathroom, Centro storico.
- Lorenzo Studio** (FLIP-EX): €1728 per night. Features: House, Entire Place, Sleeps 2, 3 bedrooms, 2 washrooms, Centro storico.
- Large double room with king-size bed, on the second floor** (roomorama): €149 per night. Features: Room - Apartment, Private Room, Sleeps 2, 1 bedroom, 1 bathroom, 1 bed, Centro storico.

Each listing includes a 'Book it' button, which is highlighted with a blue circle in the 'Lorenzo Studio' listing.

Behind the scene



Conclusion

- Large scale collaboration exists
- Large scale collaboration helps to solve large scale problems
- Only very solution based ad-hoc support

Large scale collaboration issues

- A programming language that can be used by a **Clerical worker**
- Software engineering – **modeling** and **validation**
- Operating Systems and database – **distribution of data, consistency and security**
- Measurement and Evaluation - **prediction**
- Security, **privacy and trust**
- WYSIWweS or What ou see is what we see
- **Community** Processes
- Concurrency Control
- Other area – psychology, social implications

QUESTIONS ?

Credits

- Some slides have been prepared by
 - Jorn Franke (Activity management)
 - Gérald Oster (P2P sharing)

Most of the work presented here are contribution made by members of the Coast team and the preceeding ones

<https://team.inria.fr/coast/>

Original photos are from Christian Morel (DR)